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A DETAILED REVIEW ON NON-INVASIVE CARDIAC THERAPY – EECP: A NEW INSIGHT OF TREATMENT FOR CARDIAC PROBLEMS

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Abstract:

Coronary problems like Ischemic heart diseases, coronary artery disease and stroke etc. caused due to stenosis are being the cause of most deaths over decades worldwide. Several advancements to clear the coronary stenosis like CABG and PTCA helped a lot in controlling the deaths. Holding the fact that these advancements being invasive several patients who need to be operated are taking back putting their lives at risk, to overcome this drawback, scientific field remained developing more novel advancements. One of which is ENHANCED EXTERNAL COUNTER PULSATION, EECP, a mechanical procedure to treat coronary problems overcoming the above said limitation. As this is a modern, non-invasive cardiac therapeutic option, this article reviews the procedure in terms of how it is done, what is the mechanism of action, what are the benefits and limitations of the therapy and to which patients it is recommended.

Key Words: *CAD; Angina; calss-2 devices; class-3 devices; Vacuum effect; Systolic Ventricular Output; Endothelial Dysfunctioning.*

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1. INTRODUCTION:

For Cardiac problems, the major etiological factor is *Coronary Artery Stenosis.* Stenosis occurs by lipid accumulation and plaque formation. Plaque size and various sized thrombus formed due to its rupture determines the severity of the disease and is responsible for several *Acute Coronary Syndromes.* The stenosis could be of left main vessel, primary vessel or branches of it, named as primary vessel stenosis or branch vessel stenosis. Any of these conditions may lead to cardiac problems like *Angina, Arrhythmias, Myocardial Infraction or Ischemia and Heart Failure or Heart Attack* even. These are treated with drugs like *Aspirin, Nitroglycerine, ACE Inhibitors, ARB's and Cholesterol Modifiers, Angiotensin 2 Receptor Blockers, oral Isosorbide Dinitrate, Beta-Blockers, Calcium Channel Blockers or combination of these drugs.* If the stenosis range is very high, that drugs cannot treat completely or if there is no time till the therapeutic action of drugs is obtained, then invasive procedures like *PTCA (Angioplasty)* or *CABG (By Pass surgery)* is performed. With the limitations in these invasive procedures, our scientific technology is getting updated to introduce various different procedures that can precipitate all the required benefits with minimal limitations. One such modern procedure introduced in the field of cardiology to treat various coronary problems is EECP.

Despite of invasive procedures, a *Novel Treatment Procedure, ENHANCED EXTERNAL COUNTER PULSATION (EECP),* also has benefits in treating these conditions. This is a *non-invasive cardiac therapy* that exerts pressure on the blood vessels to enhance backflow into the heart and to the heart vasculature with greater pressure to clear the blockage in vessels.

EECP is the short form of *ENHANCED EXTERNAL COUNTER PULSATION,* also known as ECP as *EXTERNAL COUTER PULSATION.* It is a *NON-INVASIVE CARDIAC THERAPY* used to increase the perfusion of blood to organs with increased pressure through its obstructed blood vessels mechanically and break the obstruction on its way. This helps in clearing the obstruction in coronary circulation seen in case of *CAD, ANGINA. EECP* is a registered trademark of *VASOMEDICAL, INC.* The FDA reclassified EECPs into Class-2 device from class-3 devices. As it is a modern technique of treating cardiac problems without making an incision on the body having all the benefits of routine surgical procedures, it can be referred as a Novel Treatment procedure for cardiac problems.

2. THEORY

2.1. STEPS IN EECP

There are only two steps in the procedure. One is to confirm the compliance of patient to the treatment procedure and next is starting of therapy. The former one is referred as *PRE EECP* sessions and the latter one is conducting the procedure, i.e., starting the therapy. EECP is done in several sessions divided into hours per day.

PRE-EECP sessions are conducted, in which the patient's complete history is taken and counselling is given along with few medical tests, like *'stress test'* is done. In this *PRE-EECP* session, complete review of the medical history of patient is taken, that includes contraindications, pre medical history and pre surgical history.

STRESS TEST is the major marker that confirm whether the patient can be treated with this therapy or not. This elucidates the severity, frequency and duration of pain associated with exercise (symptoms of *ANGINA*). Results of this test before and after the therapy marks the outcome of the patient.

Counselling in the *PRE-EECP* session focus on educating the patient about therapy (procedure) and giving them an experience with a trial period of 15 minutes. If the patient has any issues, complaints or doubts regarding therapy, they can get clarified from the health care associate in this trial period.

The latter and most important step, *EECP* sessions, begins a day after the trial period conforming the patient compliance to this therapy option in the *PRE-EECP* session.

2.2. PROCEDURE

This is a mechanical procedure in which long inflatable cuffs are wrapped around both the legs that inflate and deflate synchronously with diastole and systole of the heart respectively. This uses 3 pairs of cuffs that are wrapped around *Calf, Thighs and Buttocks of both the legs* that inflate sequentially one after the other but deflate all at once. These cuffs are connected to a computer that simultaneously records ECG of the patient. This machine uses ECG so that it inflates and deflates the cuff in synchrony to the heartbeat.

Figure 1

Figure 1 shows, arrangement of cuffs around calf, thighs and buttocks along with the ECG machine to which it is connected.

The inflation of cuffs is in the series from the cuff around calf inflates first then the cuff around thighs, next with the cuff around buttocks, exerting pressure on the blood for its easy backflow to heart. The cuffs deflate all at once in synchrony with the systole of heart, creating vacuum effect*.

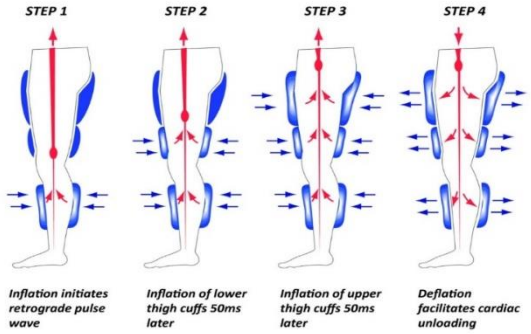

Figure 2

Figure 2 shows, pictorial representation of inflation and deflation of cuffs

2.3. MECHANISM OF ACTION

Diastole helps the vessels to drain the blood into heart chambers. Exerting pressure on the vessels in synchrony with diastole enhances the blood flow toward heart, i.e., inflation at this moment increases atrial thereby ventricular filling and cardiac output. This makes the basic criteria of EECP procedure. As cardiac output increases, there will be an increase in the oxygenation of the blood due to increased perfusion to alveoli for gaseous exchange. This enables supply of more oxygenated blood for coronary circulation.

Deflation of the cuffs in synchrony with systole creates vacuum effect in the arteries and decreases vascular resistance that increases blood pressure. This ensures sufficient blood supply to all the body parts with increased pressure. This in-turn reduces the workload on the heart so that myocardial oxygen demand decreases and heart is required with less blood supply. Due to high blood pressure the blood flows through the blocked arteries with high pressure and exerts force on the blockage, aiding in its destruction. Vacuum effect also makes the blood to perfuse through the entire body parts flushing through the vessels that are been dormant till then.

Scientific evidences show enhanced circulation stimulates new vessel formation by inducing the production of *grow factors* and release of *nitric oxide.* This helps in anastomosis of vessels naturally that can bypass the blockage and ensure supply of blood to all parts.

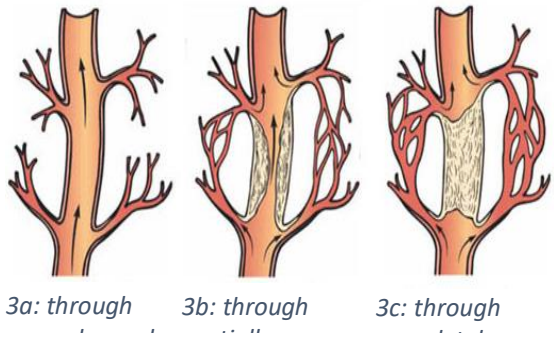

Figure 3

The figure 3b shows, passage of blood through the partially obstructed artery, gradually destroying it by exerting pressure.

Figure 3c shows, passage of blood through completely obstructed artery by enhancing lateral branch formation.

3. BENEFITS

EECP is done in several sessions, suggestive of approximately *35 sessions* to be more effective, in the range of *1 hr/day and 5 days/ week for a total of 7 weeks.* However, range alters depending on the patient compliance.

It helps in

- *Reducing Angina (chest pain),* as the myocardium is now supplied with enough oxygenated blood.
- *Reduce leg pains in Peripheral Vessel Disease,* by increasing the blood pressure and destroying the plaques formed.
- *Relief from symptoms of Ischemic Heart Disease,* by enhancing supply of oxygenated blood to myocardium.
- *Relief from symptoms of CAD,* by reducing the workload on myocardium and increasing coronary oxygenation.
- *Increase perfusion to all the organs,* by reducing vascular resistance due to vacuum effect and enhancing sufficient blood supply.
- *Increase oxygen consumption by all parts of the body,* by increasing perfusion rate.

4. EECP RECOMMENDED TO

- Those who suffer from Angina despite of maximal medication therapy.
- To those who are unfit for a stent or bypass surgery.
- Those who have Peripheral Vessel Disease.
- Those having chronic chest pain.
- Those needed to reduce medicines for cardiac symptoms.
- Those who underwent CABG or stent placement but are still experiencing angina symptoms.

5. EECP CONTRAINDICATED TO

Those who have

- *Aortic insufficiency,* in this case, increased atrial filling can enhance the risk of aortic insufficiency.
- *Recent Cardiac catheterisation,* as there is a chance of increased vacuum effect which can lead to vessel damage.
- *Atrial fibrillation,* as abnormal heart beat can disturb the inflation and deflation sequences of the cuffs associated.
- *Severe Hypertension,* as this procedure creates high pressures in the arteries, there is a risk of elevated blood pressure than required which can damage the vasculature.

6. RESULTS:

About 80% of patients experience the benefits of EECP, i.e., reduced palpitations, reduced chest discomfort and other symptoms correlating to cardiac problems caused due to coronary artery blockage. It also increases the 'Quality of Life' in comparison to *Placebo therapy.*

The cardiac patients, who underwent EECP, can persist the symptoms up to a span of 5 years.

7. CONCLUSION:

Despite of invasive procedures, like *PTCA or CABG,* performed to clear coronary stenosis of high range or in case of failure in maximal drug therapy for cardiac problems like *Angina & CAD,* we have an alternate ***Novel Non-invasive procedure*** called ***EECP***, with all known benefits without use of any drugs, even after the procedure is completed.

ABBREVIATIONS

CAD – CORONORY ARTERY DISEASE
FDA – FOOD AND DRUG ADMINISTRATION
ECG – ELECTRO CARDIO GRAPHY
CABG –CORONORY ARTERY BYPASS GRAFTING
PTCA –PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY

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CONFLICT OF INTEREST

The author declares no conflict interest.

ETHICAL STATEMENT

Not required

REFERENCES:

1. Costanzo, M. R., et al. "Heart transplant coronary artery disease detected by coronary angiography: a multiinstitutional study of preoperative donor and recipient risk factors. Cardiac Transplant Research Database." *The Journal of heart and lung transplantation: the official publication of the International Society for Heart Transplantation* 17.8 (1998): 744-753.
2. Fernández-Ortiz: Antonio, and Valentín Fuster: "Pathophysiology of coronary artery disease." *Clinics in geriatric medicine* 12.1 (1996): 1-21.

3. Bhatia, Sujata K. "Coronary Artery Disease." *Biomaterials for Clinical Applications*. Springer, New York, NY, 2010. 23-49.
4. Parisi, Alfred F., Edward D. Folland, and Pamela Hartigan. "A comparison of angioplasty with medical therapy in the treatment of single-vessel coronary artery disease." *New England Journal of Medicine* 326.1 (1992): 10-16.
5. https://www.mayoclinic.org/diseases-conditions/coronary-artery-disease/diagnosis-treatment/drc-20350619
6. http://www.eecp-therapy.com/
7. http://www.eecp-therapy.com/how-does-eecp-therapy-work/
8. http://www.eecp-therapy.com/benefits-of-external-counterpulsation-therapy/
9. http://www.eecp-therapy.com/fda-reclassifies-ecp-eecp-therapy-devices/
10. http://www.eecp-therapy.com/find-an-eecp-treatment-facility/
11. https://www.verywellhealth.com/heart-disease-4014709
12. https://www.verywellhealth.com/enhanced-external-counterpulsation-eecp-1745293
13. https://www.webmd.com/g00/heartburn-gerd/guide/upper-endoscopy?i10c.encReferrer=&i10c.ua=1#1
14. http://livoheart.com/eecp-treatment.html
15. https://www.webmd.com/heartburn-gerd/guide/upper-endoscopy#1
16. http://www.eecp-therapy.com/find-ecp-eecp-treatment-center/
17. `https://in.images.search.yahoo.com/yhs/search;_ylt=AwrxhTvUL2JbAQsAv77nHgx.?p=eecp&fr=yhs-ima-batch1&fr2=piv-web&hspart=ima&hsimp=yhs-batch1&type=batch1q50000008_nsq#id=8&iurl=https%3A%2F%2Fadvancedcardioservices.com%2Fwp-content%2Fuploads%2F2016%2F06%2Feecp.jpg&action=click
18. https://in.images.search.yahoo.com/yhs/search;_ylt=AwrxhTvUL2JbAQsAv77nHgx.?p=eecp&fr=yhs-ima-batch1&fr2=piv-web&hspart=ima&hsimp=yhs-batch1&type=batch1q50000008_nsq#id=33&iurl=http%3A%2F%2Feecpheartherapy.com%2Fwp-content%2Fuploads%2F2015%2F02%2Feecp-process.jpg&action=click
19. https://in.images.search.yahoo.com/yhs/search;_ylt=AwrxhTvUL2JbAQsAv77nHgx.?p=eecp&fr=yhs-ima-batch1&fr2=piv-web&hspart=ima&hsimp=yhs-batch1&type=batch1q50000008_nsq#id=201&iurl=https%3A%2F%2Fwww.drmorepennow.com%2Fimages%2FEECP-Treatment.jpg&action=click
20. https://www.umcvc.org/conditions-treatments/eecp-enhanced-external-counter-pulsation-treatment
21. https://www.mayoclinic.org/diseases-conditions/angina/symptoms-causes/syc-20369373